Pulpal Reactions

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U.S. Army Endodontic Short Course
Fort Gordon, GA
February 2004

I. **Microbial Irritants** – Kakehashi et al (1965) demonstrated bacteria is necessary to cause pulpal inflammation

A. Caries

1. Pulpal inflammation proportional to depth of caries
2. Pulp becomes inflamed after reparative dentin is invaded by carious lesion
3. Bacteria rarely enter unexposed pulp
4. Causes formation of reparative dentin resulting in aging of the pulp.

B. **Periodontal Disease**

1. Microorganisms enter the pulp through lateral and accessory canals
2. Necrosis results only when main foramen is invaded by bacteria

C. Anachoresis

1. Microorganisms carried via the bloodstream and localize in inflamed pulp tissue.
2. May explain necrotic pulps in traumatized teeth.

D. Systemic Infections

1. Stanley (1973) reported tuberculosis, leprosy, actinomycosis, and aspergillosis have been recovered from the pulps of patients with these diseases

II. Mechanical & Thermal Irritants

A. Depth of cavity preparation

1. The deeper the preparation the more damage to the odontoblasts and the greater the irritation.
2. Remaining dentinal thickness is most important factor in determining reactive dentin formation
3. Increased permeability of dentin closer to the pulp due to increased number and diameter of dentinal tubules

B. Speed of rotary instruments

1. The greatest damage to odontoblast occurs at speeds between 3,000 and 30,000 rpms
2. The least amount of damage to odontoblast occurs at speeds below 3,000 and above 200,000 rpms with proper coolant

C. Heat

1. Causes
    a. Restorative procedures
    b. Polishing cups
    c. Impression materials
    d. Electrosurgery procedures.

2. Factors affecting the amount of heat generated
    a. depth of cavity preparation
    b. speed of the bur
    c. size and shape of the bur
    d. amount of pressure on the bur
    e. amount and type of coolant used
    f. duration of time the bur is in contact with the tooth

3. Pulpal temperatures above $46^{o}C$ causes stasis and thrombosis in the pulp blood vessels

D. Pressure

1. Increased bur pressure can cause odontoblast displacement and increase the amount of heat

E. Type of cutting instrument

1. Carbide burs less detrimental than diamond burs
2. Larger burs produce more heat that lead to greater pulpal damage

F. **Coolants** – primary purpose is to eliminate or reduce heat generated during cutting

1. **Air**
    a. Dehydration with air causes pulpal edema and odontoblast displacement.
        i. Dry deep preparations with a cotton pellet
2. **Water**
    a. Significantly reduced temperature during restorative procedures
    b. Spray should be directed at contact point between the bur and tooth

G. Extent of preparation

1. Preparation should be gradually deepened to allow for penetration of the coolant

III. Restorative Procedures

A. Pin Placement

1. Dentinal cracks and fractures, pulpal exposures
2. Self-threading pins generate more stress
3. Amalgam pins are less damaging

B. Crown and Bridge

1. Pulpal death is a progressive response of the pulp
2. Exposes large numbers of dentinal tubules
3. Cementation generates significant pressure
4. Microleakage can cause ongoing injury

IV. Vital Pulp Therapy – any therapy that minimizes pulpal injury

A. Factors affecting success

1. Bacterial contamination
2. Duration of pulpal exposure
3. Ability of material to seal the exposure
4. Toxicity of capping material
5. Size of pulpal exposure
6. Hemorrhage control

B. Indirect Pulp Capping

1. Not recommended by the AAE
2. Attempts to remove most of caries as atraumatically as possible to facilitate tertiary dentin formation.
3. Application of zinc oxide-eugenol restoration
4. How do you know if dentin is infected or affected?

C. Direct Pulp Capping

1. Key factor is absence of infection
2. Success much greater in uninflamed pulps
3. **Not indicated with carious exposures or if mechanical exposure occurs during excavation**
4. Should be done as soon as possible after the exposure occurs

D. Pulpotomy

1. Removal of coronal pulp tissue and placement of medicament
2. Indicated in permanent teeth with immature apices
3. Contraindicated in infected pulps